WESTERN CHERRY FRUIT FLY (DIPTERA: TEPHRITIDAE): EFFICACY OF HOMEMADE AND COMMERCIAL TRAPS

A.K. Burditt, Jr.
Yakima Agricultural Research Laboratory,
Agriculture Research Service
U.S. Department of Agriculture
Yakima, Washington 98902

Abstract

Populations of western cherry fruit flies (WCFF), *Rhagoletis indifferens* Curran, were monitored at weekly intervals during the flight periods from 1982 through 1985 in an unsprayed experimental orchard planting near Moxee, Washington. Yellow Pherocon AM (apple maggot) traps usually caught more WCFF than McPhail, Rebell and other traps tested. Most of the traps also caught large numbers of other species of flies, which obscured the presence of WCFF. A bell-shaped trap constructed from the top of a plastic soft drink bottle, painted saturn yellow and baited with the Pherocon AM bait caught the largest numbers of WCFF but very few other species of flies.

Key words: *Rhagoletis indifferens,* attractants, baits, flies, McPhail traps, Diptera.

INTRODUCTION

Traps have been used to monitor fruit fly populations for many years. Frick (1952) reported that an inverted waxed food carton containing ammonium carbonate as a bait and coated on the inside surface with a sticky material was effective in catching cherry fruit flies in Washington. Banham (1973) compared the effectiveness of yellow sticky boards, bait pans containing glycine-lye and cartons containing ammonium carbonate and found that double faced sticky boards with Staley bait mixed in the Stikem were more attractive to western cherry fruit fly (WCFF), *Rhagoletis indifferens* Curran, than other combinations tested. AliNiazee (1978, 1981) showed that in the Pacific Northwest various kinds of traps could be used to time management programs for the WCFF. Monitoring fly populations has resulted in control with fewer sprays. Yellow sticky board traps, such as the Pherocon® AM (apple maggot) trap (Zoecon Corp., Palo Alto, CA), have been used to monitor WCFF populations in cherry orchards and to determine when to apply sprays based on first fly catch and seasonal distribution of fly catch (AliNaizee 1978).

The yellow sticky board trap is not specific for fruit flies. It attracts numerous other species of flies that clutter the trap and may obscure any fruit flies present (Howitt & Connor 1965, Moore 1969). This can be a serious problem for detection of the first fruit flies present in an orchard. Prokopy (1975) found that a cone-shaped yellow sticky trap attracted as many of the eastern cherry fruit fly, *Rhagoletis cingulata* (Loew), and did not attract as many other large insects as did the yellow rectangular traps.

This paper reports results of research to evaluate the effectiveness of commercial and experimental trap designs for attracting WCFF but not other non-economic species of Diptera.

METHODS

WCFF populations in an isolated stone fruit orchard at the Plant Quarantine Station, Moxee, WA, were monitored from 1982 through 1985, using Pherocon AM traps as well as experimental traps of various designs. Ammonium carbonate was applied as a bait and Tanglefoot spray as a sticky material to some of the traps and AM bait and sticky material supplied by Zoecon Corp. to other traps. Usually the experimental traps were painted saturn yellow (Day Glo Color Corp., Cleveland, Ohio).

The orchard consisted of a mixed planting, including 24 seedling cherry trees and 38 bearing cherry trees of different cultivars, as well as numerous plum, peach and apricot trees. The eastern edge of the orchard was bordered by pear and apple trees; the other borders were open sagebrush rangeland. Traps were randomized in blocks and usually placed approximately 2 m high on the south side of the cherry trees. At weekly intervals the traps were moved to the next cherry tree in the row or succession. Traps were rebaited and Tanglefoot added weekly or as needed. The number of WCFF per trap was determined weekly.

Trap catches were transformed to log (x+1) for analysis of variance and significant differences ($P \leq 0.05$) among treatment means were determined using Duncan's (1955) new multiple range test.

In 1982 traps of 23 experimental or commercial designs were tested, mostly one trap per tree, replicated at least two times. These included Pherocon AM, Rebell® (Swiss Federal Research Station, Wadenswil, Switzerland) and McPhail (Steyskal 1977) traps for comparison of efficacy. Twelve of the homemade traps were sprayed with Tanglefoot and sprinkled with ammonium carbonate as bait. Six of the homemade traps were funnels (7 to 15 cm diameter) fitted with plastic vials containing ammonium carbonate on the funnel stem. These 18 traps were painted saturn yellow. Two of the Tanglefoot sprayed traps were painted arc yellow (Day Glo Color Corp.). At least two traps of each type were placed in the orchard. Most of the traps were in the orchard from May 26 until Oct. 6, 1982.

In 1983 four experiments were conducted in which two different traps were placed in each tree. At weekly intervals, traps on the west side of each tree were moved to the adjacent tree on the south, and those on the east side were moved to the tree on the north. A total of 116 traps of various designs were placed in 58 trees from May 12 until Oct. 6, 1983. Most of the homemade traps were similar to those tested in 1982. However, in some experiments bait and/or sticker supplied by Zoecon Corp. was substituted for ammonium carbonate and/or Tanglefoot. Also, two of the experiments were replicated four times and two were replicated twice.

In 1984 eight of the more promising trap designs, based on observations made in previous years, were selected for further tests. One trap was placed in each tree, replicated five times in a split plot design. Each week the traps were removed and returned to the laboratory where the number of WCFF were counted. A duplicate set of traps was used to replace the traps as they were removed. The replacements were placed in the next succeeding tree, moving south in a row and from west to east in adjacent rows.

In 1985 only the Pherocon AM and the trap made from the bell-shaped section of a soft drink bottle (bell trap) were tested (Fig. 1). The latter traps were baited with Zoecon AM bait and sticker. Eight Pherocon and 16 bell traps were tested individually in 24 trees. Traps were moved to the next succeeding tree at weekly intervals.

RESULTS

During the period from 1982 to 1985 over 30,000 WCFF were removed from the orchard as shown in Table 1. In each year, more than 50% of the WCFF were trapped during a two-week period: the first two weeks of July in 1982, the last week of June and the first week of July in 1983 and 1984, and the last two weeks of June in 1985 (Table 1).

Each year the number of WCFF trapped declined rapidly in July and August. However, a few flies continued to be caught each week up to the end of September. The WCFF usually has a single generation each year, overwintering as pupae. Other research on WCFF from the Yakima area (Burditt unpublished data) has demonstrated that each year a few pupae do not enter diapause, resulting in emergence of second generation adults in August and September.

Response of WCFF to six types of traps in 1982 and 1983 (Table 2) showed that the Pherocon AM trap caught the most flies each year. However, the differences between responses generally were not statistically significant. In 1982 the Rebell trap and in 1983 the McPhail and bell traps caught significantly fewer WCFF than did the Pherocon AM trap. All but the Pherocon AM trap were baited with ammonium carbonate. In 1983 paired Pherocon and homemade traps baited with ammonium carbonate caught significantly fewer WCFF (40.3 flies per trap per season) than similar traps baited with the Zeocon AM bait (219.3). Most of the homemade traps caught very few WCFF and were discarded from future tests.

In 1984 the bell and Rebell traps were baited with Zoecon AM bait. These traps caught significantly more WCFF than the Pherocon AM trap and a funnel trap which was baited using ammonium carbonate (Table 2). When Pherocon traps were baited with ammonium carbonate and treated with Tanglefoot they caught significantly fewer WCFF (35.0 flies per trap per season) than did Pherocon AM traps (207.4) or Pherocon traps baited with ammonium carbonate and treated with Zoecon sticky material (265.6).

In 1985 the 24 traps caught a total of 4117 WCFF. The Pherocon AM traps caught significantly fewer WCFF (114.1 flies per trap per season) than the 2 sets of bell traps (192.8 and 207.8 flies respecctively) which were baited with the Zoecon AM bait and the Zoecon sticky material (Table 2).

Fig 1. Trap for western cherry fruit flies (WCFF), made from bell-shaped upper part of a soft drink bottle.

Table 1. Numbers of western cherry fruit flies trapped per week in an orchard at Moxee, WA.

	Number of flies trapped			
Week	1982	1983	1984	1985
1 (June)		94	17	104
2	5	399	794	545
3	30	979	2206	1071
4	530	3247	3889	1312
5 (July)	1371	2981	3286	615
6	1581	1580	1549	443
7	859	451	992	53
8	454	44	391	24
9 (August)	193	1	104	4
10	54	8	24	0
11	17	2	6	0
12	9	9	15	0
13	8	22	4	0
14 (September)	12	41	8	0
15	7	23	3	
16	2	12	11	
17	1	10	2	
18 (October)		4		
Total	5133	9907	11301	4117

Table 2. Response of western cherry fruit fly to six trap designs in 1982 - 1985, at Moxee, WA.

	Flies per trap per season			
Traps	1982	1983	1984	1985
Pherocon AM	553.3 a	103.3 a	207.4 b	114.1 b
Funnel	311.5 ab	98.0 a	40.4 b	NT
McPhail	202.0 ab	15.0 b	NT *	NT
Board	109.5 ab	70.8 ab	NT	NT
Bell	116.5 ab	2.5 b	478.8 a **	200.3 a **
Rebell	28.0 b	57.0 ab	483.2 a **	NT

Means followed by the same letter within a column are not significantly different ($P \leq 0.05$; Duncan's [1955] multiple range test).

* NT = not tested.

** Traps baited with Zoecon AM bait and sticky material

Observations showed that the Pherocon AM, McPhail and plastic board traps caught large numbers of other, non-economic, species of Diptera. These interfered with finding and counting WCFF that were present on the traps. In 1984 the bell trap caught only 24 large specimens of other Diptera in contrast to over 20 times as many specimens on the other traps. In 1985 the number of other Diptera caught was determined twice, each for a week. The Pherocon AM traps caught a mean of 49.3 specimens of other Diptera per week compared to 2.7 and 1.8 other Diptera per week for the two sets of bell traps, respectively.

DISCUSSION AND CONCLUSIONS

The use of sticky board traps, such as the Pherocon AM type trap, has been recognized for many years as a technique for monitoring fruit fly populations and for guidance in application of sprays for control of these pests. Monitoring requires that traps catch fruit flies when they initially emerge from the puparia and that low populations of fruit flies be detected. Large numbers of other species of non-economic Diptera may obscure the presence of the species being sought. Therefore, an ideal trap would be specific for WCFF. In this study a bell trap baited with Zeocon AM bait and sticker met these requirements. It caught WCFF early in the season, usually caught as many as or more WCFF than the other types of traps and caught significantly fewer non-target species of Diptera than other trap designs tested. Further tests are needed to determine if the bell trap would be effective in attracting other species of fruit flies such as the black cherry fruit fly, *R. fausta* (Osten Sacken).

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